NON-PUBLIC?: N
ACCESSION #: 9506290196
LICENSEE EVENT REPORT (LER)

FACILITY NAME: Palisades Plant PAGE: 1 OF 4

DOCKET NUMBER: 05000255

TITLE: LICENSEE EVENT REPORT 95-003 - MAIN FEEDWATER PUMP TRANSIENT RESULTING IN A REACTOR TRIP
EVENT DATE: 05/22/95 LER #: 95-003-00 REPORT DATE: 06/21/95

OTHER FACILITIES INVOLVED: DOCKET NO: 05000

OPERATING MODE: N POWER LEVEL: 46 %

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION:
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
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COMPONENT FAILURE DESCRIPTION:
CAUSE: X SYSTEM: SJ COMPONENT: P MANUFACTURER: W318
REPORTABLE NPRDS: YES

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

On May 22, 1995, at 1110, with the plant operating at 46% power, the reactor was manually tripped. At the time of the trip, K-7A and K-7B main feedwater pump turbines had both tripped, resulting in a loss of all main feedwater. The vibration on K-7A had increased earlier and System Engineering was brought in to investigate the problem. A decision was made to reduce reactor power and take K-7A off line. While preparing to reduce reactor power, K-7A tripped. Later, the trip was attributed to a failure in the layshaft assembly which uncoupled the governor controls from the main turbine shaft and resulted in the turbine tripping on overspeed. The control room operator took manual control of K-7B and ramped the turbine up to full speed, as required by Off Normal Procedure ONP-3, "Loss of Main Feedwater." Later when "B" Steam Generator (E-50B) level was recovering too quickly, the control room operator took manual control of the feedwater regulating valve (CV-0703) to manually throttle the valve. The "B" Steam Generator level reached the high level override

setpoint which immediately closed the feedwater regulating valve CV-0703. Rapidly closing the feedwater regulating valve CV-0703 caused an immediate drop in load and K-7B turbine speed increased above the overspeed trip, resulting in the turbine tripping on overspeed. After verifying that K-7B had tripped, the control room operator manually tripped the reactor.

The cause of this event was the failure of the locknut on the layshaft assembly of K-7A, allowing the layshaft drive gear to walk down the shaft.

END OF ABSTRACT



Event Description

On the morning of May 22, 1995, the recorder for K-7A main feedwater pump turbine SJ;P! shaft displacement had a small movement and the pen for recording the vibration between the turbine and governor started marking a wider band than normal (Worthington Pump Driver; Turbine Frame ITV2X3). At 0700, the control room operator noticed the vibration increasing on the recorder and notified the Secondary Auxiliary Operator and the Shift Supervisor. The vibration went from 1.6 mils to 2.0 mils (the alert indication setpoint for vibration is 2.5 mils). The pump and turbine were checked along with other local instruments. A rise in the noise level was the only abnormality noticed by the Shift Supervisor and Auxiliary Operator.

The Shift Supervisor contacted the System Engineer for further evaluation. After a review of K7A, the System Engineer contacted the Plant Performance Engineer to take vibration readings and an oil sample. Chemistry checked the oil sample for water and small suspended solids,, but both tests were negative. An oil sample was sent off site for testing and later found to be normal.

The Control Operators reviewed the Off Normal Procedure (ONP-3) for "Loss of Main Feedwater" in case of a Main Feedwater Pump (MFP) trip. A meeting was held with upper management to review the course of action. At around 1100 the decision was made to reduce reactor power and remove K-7A from service so it could be checked out further. Just prior to starting the power reduction K-7A tripped.

After K-7A tripped, the control room operator verified that "A" Main Feedwater Pump tripped, took manual control of K-7B, and ramped the turbine up to full speed, as required by ONP-3. The "B' Main Feedwater

Pump (MFP) was at maximum speed 24 seconds after A-MFP tripped.

Then, at 36 seconds, the same control room operator took manual control of the turbine and reduced load while the other control room operator continued to manually drive control rods in to reduce reactor power. In 58 seconds, the feedwater flow was equal to steam flow for both steam generators. (Per ONP-3, Section 4.1, subsequent actions, "Stop the power reduction when feed flow indication becomes slightly greater than steam flow indications for both S/Gs.") At 1 minute and 10 seconds the downpower was momentarily halted at approximately 60% power.

Because the "B" Steam Generator (S/G) level was not recovering, the Control Room Supervisor directed an additional load decrease. At 1 minute 48 seconds, the control room operators started lowering reactor power and turbine load. At 2 minutes 48 seconds, the load decrease was stopped at approximately 46% power.



The "B" S/G level began to rise rapidly and at 3 minutes 16 seconds the control room operator took manual control of "B" S/G feedwater regulating valve, CV-0703. The valve was manually closed to 20% at 3 minutes 52 seconds and not manually closed any further after that. At 4 minutes 28 seconds the "B" S/G level exceeded 84.7% and the high steam generator level override circuit actuated to close CV-0703.

When CV-0703 rapidly closed from 20%, the result was a large drop in load for K-7B. This immediate drop in load was enough to allow the speed of K-7B to increase above the overspeed trip. The "B" MFP tripped 4 minutes 40 seconds after "A" MFP tripped.

The control room operator then verified that "B" MFP had tripped and at 5 minutes 12 seconds the Reactor was manually tripped. The immediate actions of Emergency Operating Procedure (EOP-1), "Standard Post Trip Actions," and EOP-2, "Reactor Trip Recovery" were performed and verbal verification was completed. All EOP procedure steps were completed satisfactorily.

Plant and operator actions taken in response to MFP trips were in accordance with procedures, with no safety significant deviations or abnormalities. Although not required by the event, both trains of engineered safeguards equipment were operable and available for use at all times. This event did not have an adverse impact on the operational safety of the plant or upon the safety of plant personnel or the general public.

Cause of the Event

The proximate cause of the event is the "A" main feedwater pump layshaft locknut lockwasher tab failure which allowed the layshaft locknut and driven gear to walk off the shaft.

Contributing causes include:

1. The feedwater pump gain control setting is set as low as possible. As a result, the MFPs are slow to respond to a speed control signal. Because of this, operator action is required to take the MFP speed control to manual and increase pump speed if an attempt is made to provide the feedwater flow required to compensate for the loss of a main feedwater pump. An Asea Brown Bovari (ABB) simulation ("Final Report Palisades Nuclear Plant; Feedwater Control System Evaluation, July 1992") recommended the feedwater control system be fine tuned to make the system responsive enough to handle this type of transient with the feedwater system left in automatic. This slow main feedwater pump response results in the MFP speed staying high on a Reactor trip. The high MFP speed, coupled with the automatic shift of the feed regulator valves to manual, assures that ample feedwater is maintained for core cooling; it also, however, requires that a control room operator manually trip both MFPs on a reactor trip to prevent overcooling the primary coolant system.



2. The "B" main feedwater pump governor control maximum speed is so close to the overspeed trip setpoint that it allows an overspeed trip on a loss of load condition.

Corrective Actions

Corrective Actions are as follows:

1. Determine the root cause for the failure mode of the "A" MFP layshaft lockwasher locking tab. Make necessary changes to both MFPS.

2. Evaluate the feedwater control system for this event and the changes suggested by the 1992 ABB report. Review the effect of any changes on the response of the feedwater system for other events. Make any required changes to both feedwater control systems.

3. Evaluate the MFP governor control setpoint of 5250 RPM and its relationship to the overspeed trip setpoint.

Previous Events

Licensee Event Reports since 1990 were reviewed. Four reactor trips resulted from a loss of one of the main feedwater pumps. The failure mechanisms and root causes, however, do not correspond with those identified for this event.

Additional Information

The lockwasher failure is similar to an event described by D-PAL-91-122 when K-7A was ready to return to service on July 20, 1991, but was shut down because of noise. The layshaft locknut was found loose.

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